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ABSTRACT

A tech prep (TP) curriculum merges academic programs and career preparation and is a direct attempt to rethink both the purpose and the method of secondary schooling for many students. TP sprang from the employment legislation of the 1960s and was given strong impetus by the education reform movement of the 1980s. Congress authorized national funding for TP programs in the 1990 Perkins Act. Applied academics are the heart of TP. A TP curriculum is competency based and fuses secondary and postsecondary education into one articulate program. Its four instructional strategies originate from the characteristics of the modern workplace. They are applications-based instruction, cooperative learning, problem solving, and learning styles. A number of elements crucial to the success of the TP program require professional development for the faculty. Schools must form links with outside resources. School leaders must change faculty attitudes. Faculty must develop a balanced core of common learning, be trained in alternate methods of measurement, collaborate with other disciplines, and be trained in ways to provide students with active learning opportunities. TP calls for partnerships between schools and business and industry. Characteristics of effective partnerships are a school-business/industry liaison, a written specific agreement, collaborative leadership, meaningful incentives for participation, outcome-based and measurable results, and continuing support. TP has been implemented successfully in Indiana, North Carolina, and Texas. (Contains 30 references.) (YLB)

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# Tech Prep: A Strategy for School Reform

James E. Green
Roy A. Weaver

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Series Editor, Donovan R. Walling

# Tech Prep:
# A Strategy for School Reform

by
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and
Roy A. Weaver

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# Defining Tech Prep

High school students traditionally enroll in one of several types of programs: college preparatory, general studies, or vocational-technical. While the purposes of college preparatory and vocational-technical programs seem to be understood by educators, general studies programs suffer from a lack of identity or mission. They do not prepare high school students for college, nor do they prepare them for employment in today's industry or commerce. Yet from one-third to one-half of the nation's high school students are enrolled in a general studies curriculum. Tech Prep is a school reform movement that promises to redefine education programs for these students, who have become the "neglected majority," as they have been aptly described by Dale Parnell (1985).

Tech Prep targets this large group of students, who now are unprepared for either college or work, and offers them a curriculum that integrates academic study with workplace applications. The purpose is to prepare graduates to work in a world now defined by global markets, light-speed communications, and emerging technologies. In short, tomorrow's worker must know more and be able to perform more complex skills than in the past – especially in problem solving, interpersonal communication, and lifelong learning. Tech Prep is designed to meet these needs.

How does Tech Prep differ from previous efforts to train a vital work force? First of all, Tech Prep is not merely a new label for voca-

tional education. The curriculum is far more comprehensive than that, and its purpose extends beyond entry-level training into a particular vocation.

Many vocational education programs are designed to prepare students for employment immediately after high school. Tech Prep is designed to prepare a student for postsecondary education or training in advanced technologies. Moreover, the curriculum should prepare students to be lifelong learners and to adapt as technologies become more advanced.

Tech Prep does not have to be a four-year program, two years of high school followed by two years in a community college, culminating in an associate degree, although it often is characterized as such. Many models are possible for implementing Tech Prep, including apprenticeships. Nor is Tech Prep intended to train workers strictly for "high-tech" industries. Use of the term "technology" in Tech Prep is not occupationally specific. Instead, Tech Prep is a new way of thinking about the purpose and mission of our secondary education system.

In 1990 Congress amended the Perkins Vocational and Applied Technology Education Act to include the Tech Prep Act. Suddenly Tech Prep became a national movement. The Tech Prep Act includes several features that serve as a working definition (Hoerner 1991):

1. Tech Prep combines a secondary education program with a postsecondary education program.
2. Tech Prep is implemented by an articulation agreement that consists of two years of secondary education followed by two years of higher education or two years of an apprenticeship program.
3. The secondary education phase in Tech Prep consists of a common core of required competencies in mathematics, science, communications, and technologies.
4. A Tech Prep program is designed to lead to an associate degree or a certificate in a specific career field and effective employment or transfer to a four-year baccalaureate degree program.

These features make up a legal definition for Tech Prep, but there are other aspects that make a Tech Prep curriculum truly a merger of academic programs and career preparation. The definition used by Illinois is typical (cited in Luft 1993, p. 16):

> [Tech Prep] is a planned sequence of courses, both academic and technical, that begins in the 9th grade and is articulated with a post-secondary experience leading to an associate of applied science degree. . . . Tech Prep prepares students with the skills and competencies necessary to meet employers' performance standards not only for entry-level jobs, but also for career advancement.

These points are important to a common definition of Tech Prep, but they do not fully convey the shift in thinking that educators must make in order to comprehend the potential for Tech Prep to reform our education system.

## Tech Prep as Reform

The reports on education reform from the last decade left many educators feeling apprehension, doubt, urgency, and even outrage. The dialogue on education usually centered on one assertion: America is having difficulty competing in international markets because the nation's secondary schools are not doing their job.

Business leaders became concerned that our schools were not producing employees with the fundamental skills needed in a modern economy that is increasingly global and technological. They now have begun to work with educators to identify the problems and plan a course for improvement. In 1992 the Secretary's Commission on Achieving Necessary Skills (SCANS) reported that more than half of our young people leave school without the knowledge and skills needed to find and keep a good job. The SCANS findings are echoed by other reports. In a recent Harris poll (1991) for the Committee for Economic Development, a mere one-third of employers thought that recent high school graduates have the ability to read and understand written and verbal instructions; only one-fourth said that recent graduates are capable of doing the arithmetic functions needed for work.

These observations by the leaders of education and business are chilling. They appear at a time when workers are expected to do more thinking in a workplace that has been transformed. Workers must solve problems, work cooperatively with their co-workers, and continue

to develop new skills in order for American business to compete with other world-class economic powers. These new demands require that schools prepare students for the transition to a work force that can stand up to international competition.

Tech Prep is a direct attempt to rethink both the purpose and the method of secondary schooling for a vast number of students. Traditionally, we have thought in dichotomous terms of the world of school and the world of work. But as Willard Wertz observed, "There aren't two worlds – education and work, there is one world – life" (William T. Grant Foundation 1988). Hands-on approaches to solving real problems in real-world settings are a necessity, rather than an alternative to the norm.

The 1990 SCANS Report stressed that relevance is the key to school reform. The authors observed, "The lack of any clear direct connection between education and employment opportunities for most young people is one of the most devastating aspects of the existing system" (cited in Hoerner 1991). Tech Prep's emphasis on applied learning directly responds to this call for making the curriculum more relevant to the modern workplace.

Most important, at the heart of Tech Prep is the belief that an elitist approach to education will not work. If schools focus only on students who are expected to complete baccalaureate or higher degrees, the nation's chances of remaining competitive will dim. Schools must become places where all students, including the "neglected majority," are given the chance for an education that is suited to the work they will perform in the next century.

# The History of Tech Prep

The philosophy behind Tech Prep goes back to Benjamin Franklin's proposal to reform education in the American Colonies. In his "Proposals Relating to the Education of Youth in Pennsylvania," Franklin introduced a plan that parted radically from tradition and emphasized the "learning of those things that are likely to be most useful." The curriculum of his famous academy was a sharp departure from the Latin grammar schools and English classical schools that dominated eighteenth century education. Franklin's ideas found a modern philosophical home in the pragmatism of John Dewey and came to maturity in the Progressive Education movement of the 1920s and 1930s.

Tech Prep itself sprang from the manpower legislation of the 1960s and was given strong impetus by the education reform movement of the 1980s. The urgent demands of global competition and technological progress now push for widespread acceptance of Tech Prep in the 1990s.

The Manpower Development and Training Act of 1962 and the Vocational Education Act of 1963 stimulated the Oregon State Board of Education to design a sequence of specific courses in both high schools and community colleges to prepare graduates in entry-level job skills or for further education. The articulation of secondary programs with community college programs was a primary feature. Dale Parnell, Oregon's superintendent of public instruction at the time,

directed the task forces that developed this plan. His book, *The Neglected Majority*, grew out of these early efforts.

The next major impetus for Tech Prep came from the Education Amendments of 1972 and the National Institute of Education studies of the early 1970s. Bender (1973) reported that a major proportion of high school students were not enrolled in courses that prepared them to enter the work force after graduation. The NIE studies found that these students also were not prepared for a four-year college program. As a result of this legislation, the National Institute of Education pushed for an articulation model that would integrate secondary and post-secondary education programs.

Both Michigan and North Carolina responded to these reports with plans for career education that included bridging two years of high school to two years of college (Michigan State Department of Education 1975, p. 14; Woelfer 1978, p. 55). Other states followed suit; and during the 1980s, support for programs that stressed secondary and post-secondary articulation and performance-based competencies grew nationally.

The Tech Prep movement was given another boost by the publication in 1984 of *The Unfinished Agenda: The Role of Vocational Education in the High School*. This report, issued by the National Commission on Secondary Vocational Education, called for stronger ties between job training and academic studies. The commission argued that merely adding academic courses would not help prepare students to enter the work force, because more than 80% of the jobs in America do not require a college degree. The curriculum reform promoted by the commission emphasized the integration of academic skills with career guidance and the development of general employability skills. In addition, the commission specifically recommended that states develop plans to articulate secondary and post-secondary programs and to encourage partnerships between schools and business and industry.

Several other proposals followed *The Unfinished Agenda*. The most notable was Dale Parnell's *2+2 Tech Prep/Associate Degree Program: A Working Degree for America* (1984), which described a combination of secondary and post-secondary education to create a program of applied academics with a career orientation leading to an associate degree. While defining Tech Prep as a program that is intended to parallel a college-prep program, Parnell clarified its purpose as developing broad-based competence in career areas, rather than focusing on specific job skills.

The most recent stimulus to Tech Prep came with the new Perkins Act in 1990, when Congress authorized national funding for Tech Prep programs. With the seed money provided by the federal government, state-level programs began to proliferate. By 1 July 1991, there were approximately 380 Tech Prep programs in 39 states. Hoerner (1991) predicted that the number would soon swell to more than a thousand.

# The Tech Prep Curriculum

A Tech Prep curriculum combines the characteristics that form the cornerstones of any successful secondary school curriculum. These are application of principles, integration of subject matter, cooperation among pupils, individualization of instruction, evaluation using competency-based criteria, and articulation with advanced programs. These are not new ideas, nor are they unique to Tech Prep.

## Applied Academics

Applied academics are the heart of Tech Prep. In fact, *applied academics* has been identified with Tech Prep so strongly that the two terms often are considered to be synonymous. The Southern Regional Education Board (SREB) State Vocational Education Consortium provides a good working definition of applied academics.

> Applied academics combine the essential elements of the college preparatory curriculum with effective learning and problem-solving strategies in a broad technical or business field. The academic subject matter includes the essential concepts, facts and procedures normally identified with college preparatory language arts, mathematics, and science courses. Students become familiar with the knowledge, technology, and skills in a business or technical field and with ways to use academic knowledge to perform tasks and solve problems within the field. (SREB 1992, p. 39)



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In Tech Prep, real-life applications are the basis for learning academic subject matter. Therefore, students understand the importance of what they are learning. In addition, when subjects are taught using applications and concrete examples, students more readily comprehend difficult concepts.

In the past few years, many examples of applied academics have become available for teachers. *Tech Prep Associate Degree: A Win/Win Experience* (Hull and Parnell 1991) includes several illustrations of how core academic courses can be adapted to become "applied academics." Likewise, *The Cunning Hand, the Cultured Mind: Models for Integrating Vocational and Academic Education* (Grubb et al. 1991) is an excellent resource for teachers who desire a thorough explanation of applied academics. It lists materials related to the integration of vocational and academic courses.

Another source of model instructional units can be found in the *Indiana Tech Prep Training Manual* (Herron and Depew 1992). Several chapters are devoted exclusively to model instructional units designed for Tech Prep, with an emphasis on applied academics.

Applied academics require that different subjects be integrated. In Tech Prep, instructional units and even entire courses of study are designed without the normal disciplinary divisions, because problems in the workplace are not confined to traditional disciplinary categories.

Of course, a Tech Prep curriculum is not a hodgepodge of situational activities. It is carefully planned around problems that require complex solutions. Therefore, the application of diverse knowledge and skills is integrated into projects for students. This approach resembles the problem-solving environment of the workplace. A Tech Prep curriculum seeks to re-establish the integration of subject matter.

Several strategies are useful for creating an interdisciplinary curriculum from the compartmental designs found in most secondary and post-secondary schools. First, teachers of different subjects can jointly plan their courses so that they deal with the same problems and applications but from different disciplinary perspectives. This strategy

has the advantage of not requiring a total reconstruction of a school's curriculum, which is difficult to accomplish in any school. At the same time, it gives students the opportunity to see that a problem often presents a meeting place for several academic subjects and methods. Tech Prep teachers also will teach units in their own classes that integrate other disciplines.

Group planning is a necessity when designing a course that involves other academic areas. One example, provided in the *Indiana Tech Prep Training Manual* by Green and Herron (p. 6), illustrates how teachers can work together to integrate their disciplines to achieve a curriculum characterized as applied academics.

> If a science class were conducting an environmental impact study as a class project, the English teacher would join the class for a period of time to teach students how to write the final technical report. The science teacher would evaluate the report for its scientific accuracy; and the English teacher would evaluate the report for its quality of composition. Lest English teachers end up getting the "short end" of these "trades," the school's curriculum design will need to include a plan for content specialists to contribute to the units prepared for implementation in the English classes. Opportunities for this type of collaboration are limited only by the imaginations of the teachers.

The most ambitious approach for implementing Tech Prep is a total re-design of the school curriculum around applications. A curriculum based on applications forces teachers to consider the relevancy of a concept or a skill from the very first point in the process of instruction. Again, an example from the *Indiana Tech Prep Training Manual* illustrates how this degree of integration can be accomplished.

> An example would be a course titled "Business, Industry, and the World's Environment." Core knowledge from all the natural and social sciences would need to be integrated with mathematics, language arts, and technology. Class projects would be designed to include collecting physical as well as demographic data and using various mathematical models to analyze the data. The reading and writing skills that

> these specific content areas demand makes the infusion of all the language arts a necessity, and the use of scientific equipment and computer technology as tools properly places the activities in a technical context. (p. 6)

While genuine interdisciplinary courses offer great promise for implementing applied academics, they have their disadvantages. Team teaching almost always is required; and modular, flexible scheduling becomes a necessity. Logistical challenges are menacing; therefore, broad-based support among a school's faculty is crucial for successful implementation.

## A Competency-Based Curriculum

A Tech Prep curriculum is competency-based. The curriculum stresses explicit skills that students need to acquire in order to be successful in the modern work environment. These competencies do not always have to be stated in specific and behavioral terms; they can be as general as "becoming effective in interpersonal communications" or "learning to work cooperatively with other persons."

Teachers in vocational and technical education have had extensive experience in developing and managing competency-based programs. But the question in Tech Prep is how narrow to make the competencies. Indeed, a Tech Prep curriculum will stress the more general type of competencies over the specific occupational skills common in vocational education programs.

The 1992 SCANS report outlined the competencies needed by workers. Based on a comprehensive study of what employers said workers require in order for business and industry to remain competitive, the SCANS list offers a three-part foundation:

1. Basic Skills. These include reading, writing, arithmetic and mathematical competence, and good listening and speaking ability.

2. Thinking Skills. These include creativity, the ability to make decisions and solve problems, the ability to visualize abstract information, and learning and reasoning skills.
3. Personal Qualities. These include responsibility, self-esteem, sociability, self-management, and integrity.

Complementing the three-part foundation is a list of five competencies:

1. The ability to identify, organize, plan, and allocate resources.
2. The ability to work with others.
3. The ability to acquire and use information.
4. The ability to understand complex interrelationships in systems.
5. The ability to work with a variety of technologies.

Ideally, competency-based objectives should be easy to observe and measure. Also, performance of these competencies should resemble applications in the real world as much as possible. However, a Tech Prep curriculum emphasizes complex skills; thus observation of discrete skills often is difficult, if not impossible. As a consequence, Tech Prep requires alternative forms of assessment, such as portfolios.

Tech Prep stresses assessment based on students' performance in realistic settings. A Tech Prep teacher may evaluate a complex product, such as a videotaped sales presentation produced by a team of students. Or the teacher may observe students as they perform actual tasks, for example, creating a computer database for an inventory. Short-answer or multiple-choice tests are less common.

## Articulation

A Tech Prep curriculum fuses secondary education and postsecondary education into one articulate program. This kind of articulation means much more than just giving college credit for courses taken in high school or mapping out high school prerequisites for college courses.

In Tech Prep, articulation is designed to provide students with a smooth transition from one level of schooling to another. This calls for educators at both levels to work in a spirit of cooperation for the benefit of the students. They must strive to establish and maintain a coherent system that makes the best use of a community's educational resources and a student's investment of time, effort, and money.

Planning is critical if this type of articulation is to succeed. This is particularly true for Tech Prep, because each Tech Prep program involves two or more institutions. Dornsife (1992, pp. 83-87) provides 10 principles that are central to articulation planning:

1. Leadership and commitment must be present among all participants.
2. Early faculty involvement is essential in the design of the courses.
3. Respect and trust must be formed between the faculties and administrations of the institutions.
4. All the participating institutions should benefit from the program.
5. There should be a written articulation agreement.
6. It is essential to keep communication channels open.
7. It is advisable to keep the initial goals modest.
8. Individuals must be designated to be accountable for the program.
9. The articulation agreement must describe the competencies to be shown by the students.
10. Faculties at all the participating institutions must focus on the common goal rather than on their individual turfs.

# Instructional Strategies for Tech Prep

The skills needed for tomorrow's work force require teachers to use different methods of instruction, methods that resemble the way students will function in the modern workplace. Green and Mendenhall (1992) describe four methods that are vital to a Tech Prep program:

1. Applications-based instruction: applying general knowledge and basic skills to novel and specific situations.
2. Cooperative learning: communicating with others and sharing responsibility and accountability to complete tasks.
3. Problem solving: thinking critically to solve problems.
4. Learning styles: recognizing and employing a variety of learning styles.

These four instructional strategies originate from the characteristics of the modern workplace.

## Applications-Based Instruction

Applications-based instruction differs from the standard sequence of instruction because application precedes theory; that is, instruction moves from the concrete to the abstract. In the traditional sequence of classroom instruction, application follows theory. In Tech Prep, students apply their knowledge of physics, chemistry, math,


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and other fields to technological systems in order to learn the theory they will need in the workplace.

All the other Tech Prep instructional strategies are incorporated into applications-based instruction. When instruction is based on application, students must solve problems. Through application, they gain general knowledge and their knowledge is tested. Moreover, the applications-based instruction found in Tech Prep addresses the need to teach to different learning styles, because a variety of media and circumstances from workplace settings can be used. Finally, students can apply knowledge and practice skills while they learn to cooperate in groups.

## Cooperative Learning

Cooperative learning is at the heart of Tech Prep for two reasons. First, there is mounting evidence that cooperative learning helps students master academic material (Lunetta 1990). Second, employers universally value workers who can work well with others. Cooperative learning gives students the needed experience in interpersonal skills.

According to Robert Slavin (1991), two elements must be present in order for cooperative learning to be effective: group goals and individual accountability. What Slavin observes in classrooms, supervisors in business and industry also observe in the workplace. Group goals and individual accountability come straight from the real world of work.

## Problem Solving

The modern workplace requires higher-level thinking skills. Only a few years ago, factory workers performed mostly repetitive tasks. Now robots do these jobs, and human workers must tackle more complicated tasks. Thus problem solving is a key aspect of Tech Prep.

Problem solving is rooted in applied learning and requires an interdisciplinary organization of subject matter. It frequently occurs in a group process, where individual students bring their unique talents and skills to the creation of a collective solution.

The SCANS report identified creativity, decision-making, reasoning, and problem-solving as the skills that students should develop. Of course, they are not discrete skills which exist independently. We must make decisions when we solve problems, and we must be creative to generate alternative solutions and to test those solutions.

## Teaching and Learning Styles

Teachers know that students learn in very different ways. In addition, teachers themselves differ; and each teacher has a different teaching style. Tech Prep emphasizes the importance of teaching and learning styles as a way to reach and teach more students. In any classroom, but especially in Tech Prep, teachers need to make sure that their students can choose from a variety of teaching strategies that foster academic success.

Teachers generally teach to learning styles that they themselves favor, and students who are successful in a given class usually favor the learning style of that teacher (Campbell 1991). But the object is for all students to learn, not just those whose learning style matches that of the teacher. Teachers have a professional responsibility to use diverse strategies to give each student the best chance to learn.

## Staff Development for Tech Prep

Because Tech Prep requires a combination of approaches to teaching, many faculty will need to adopt new roles. Administrators who are philosophically committed to the program and provide appropriate leadership are the key to helping faculty make the transition. Similarly, it is essential to select teachers who are among the best in their disciplines.

Some faculty will need to rethink their views about planning, selection of curriculum materials, choice of student activities, and methods of evaluation. There are a number elements that are crucial to the success of the Tech Prep program and that require professional development for the faculty.

First, schools must form links with outside resources, especially employers in the community. In terms of faculty development, this means that meetings must be held so that there is a clear understanding of the personal attributes, knowledge, and skills that employers expect students to have when they complete the Tech Prep program. At the same time, it is important for Tech Prep faculty to monitor employment data and vocational trends in order to adjust the curriculum to meet the changing needs of the job market.

Second, school leaders need to work on changing faculty attitudes. Too often, curricular innovations are doomed to failure because they are viewed as less valuable than the "traditional" curriculum. Often, the students who are enrolled in the program are viewed as "disad-

vantaged." A deficit model of Tech Prep must be avoided. An orientation program should be developed for faculty who will teach in the Tech Prep program to ensure that they understand the important relationships between the curriculum and employability.

Faculty also need to develop a "balanced core" of common learning. The process of arriving at a balanced core requires negotiation among the faculty representing the various disciplines. Since Tech Prep is competency-based, faculty teaching core courses need to redesign their classes to reflect workplace applications.

Tech Prep faculty must spend time identifying and describing what students are expected to do, and they must use a variety of ways to measure student performance. While traditional testing is still appropriate, greater reliance will be placed on observation, product analysis, and self-analysis. In order to use multiple sources of information reliably, Tech Prep faculty must be trained in these methods of measurement and must know when each is appropriate.

Interdisciplinary collaboration will become increasingly important, and faculty must collaborate in entirely new ways to ensure that the Tech Prep program is integrated throughout the school curriculum. All faculty need an in-depth understanding of the content, philosophical bases, skills, and research-based approaches to instruction. In order to develop such an understanding and to build a collaborative relationship, time must be provided for faculty to plan, and a flexible schedule will be needed to accommodate team planning.

Because Tech Prep focuses on providing students with active learning opportunities, the faculty will need training in ways to accomplish this. Most courses include a laboratory that enables students to explore real-world problems, and emphasis is placed on problem-solving activities through group work. Many faculty will need professional development activities to sharpen the skills needed for these new programs.



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## Partnerships with Business

Tech Prep calls for partnerships between schools and business and industry. Partnerships are not new, and they have been on the increase since the 1970s. In a survey of 305 Fortune 500 companies, 93% said they were engaged in some type of partnership with schools (Kuhn 1990).

Tech Prep program leaders can find numerous examples of partnerships that will serve to guide planning. Some of these programs target students who are at risk of dropping out of school. Other partnerships target academically able students. Many businesses are interested in curriculum reform and teacher development.

In 1990, the Boeing Corporation took part in an unprecedented partnership with schools. Boeing awarded more than $400,000 in grants to schools to implement the Tech Prep curriculum. Currently, 42 high schools are implementing one of three curricular models. In addition, Boeing provides summer internships to selected teachers.

Tech Prep program leaders will find a vast resource of volunteers from business and industry. For example, the Federal National Mortgage Association (Fannie Mae) has more than 100 volunteers who serve as mentors for high school students. These mentors offer direction in academic and vocational areas and serve as role models for students.

Business and industry are willing to provide site-based training in order to relate work-skill development to the high school curriculum.

One example is Project ProTech, an innovative school-to-work transition program for Boston high school students pursuing health care careers. The aims are to train students for careers in the health care field, to give them the professional certification required by health employers, and to provide the hands-on experience needed to compete in today's technologically demanding workplace.

ProTech is a collaborative effort among the Boston Public Schools, six Boston Hospitals, and Bunker Hill Community College. Beginning with their junior year of high school, students who participate in the program train as both students and employees. In school, they study math and science courses designed for ProTech; and in the participating teaching hospitals of Boston, they receive on-site classroom instruction taught by health care professionals. Hospital staff members support students' professional and intellectual development by acting as mentors, teachers, and role models. In the fall of 1991, 90 students from four Boston high schools began studying in the ProTech program

## Characteristics of Effective Partnerships

To ensure that effective partnerships are developed and sustained, certain characteristics should be present:

1. *A school-business/industry liaison should be identified.* A key leader in the school corporation and the business or industry must be identified to guarantee that effective communication occurs, elements of the partnership are included in an agreement, the partnership is operationalized, and the success of the partnership is measured.

2. *A specific agreement should be written.* Parties involved in a partnership need to share in a written, formal form what they expect to put into and get out of the partnership. The level of commitment should be underscored. Both short- and long-term goals should be noted. The allocation of resources (money, time, personnel, equipment, space) in support of the partnership should be outlined.



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3. *Collaborative leadership should be developed.* It is critical that key leaders from school corporations and business and industry actively participate in all aspects of the partnership. The use of high-level administrative personnel is more than symbolic. Involvement at this level communicates a seriousness and commitment that cannot be attained in any other way. At the same time, it is equally critical that faculty and business employees at other levels have a meaningful role in collaborating. Faculty and employees are most likely to be the persons who carry most of the responsibility for seeing that the partnership works effectively.

4. *Meaningful incentives for participation should be provided.* While many faculty and employees will volunteer to participate in partnerships simply because they value the experience, the commitment of incentives attaches a greater sense of importance to the partnership. A stipend, released time, travel opportunities, professional development activities, or other forms of support should accompany involvement in partnerships.

5. *Results should be outcome-based and measurable*. From the outset, parties involved in the partnership should be able to specify clearly what they intend to get out of the partnership. These anticipated results should be part of the written agreement. An example of a measurable outcome might be to decrease the number of students assigned to a dropout program by 15 students as a result of providing tutors from a local business in conjunction with teachers in an alternative school program.

6. *The agreement should be fully implemented.* Once an agreement has been formalized, an organizational structure must be established to carry it out. Clear definitions of roles must be developed, so that there are no misunderstandings regarding the responsibilities of the respective school and business.

7. *Continuing support should be provided.* A partnership, like any organization, will not operate even semi-independently without continual support. Partnerships can be fragile because they are activities that both the schools and businesses undertake beyond their primary work.

## Where Tech Prep Works

Tech Prep has been implemented successfully in a number of states and is increasing in popularity. Indiana, North Carolina, and Texas have provided leadership in the development of Tech Prep programs, but other states also have moved to encourage such program development. Every state legislature has debated initiatives to link school and work. Most have passed legislation and provided funding to explore ways to prepare a work force to be more competitive in the 21st century.

### Indiana

Indiana was the first state to call for the development of Tech Prep through legislation. In 1987, legislation required the Indiana Department of Education to develop a technology preparation curriculum and to implement the curriculum in pilot schools so that it would be available to all secondary school students by 1995-96 (Indiana Department of Education 1992).

Currently, seven pilot sites are in their third year of program implementation. An overview of one of these sites, Bartholomew Consolidated School Corporation in Columbus, Indiana, illustrates the implementation of the above components. Offered at both Columbus East and Columbus North high schools, the Tech Prep curriculum focuses on problem solving, decision making, and group-process skills (Bartholomew Consolidated School Corporation 1993).

A description of two of the courses developed for the Tech Prep curriculum reflects the integration of traditional disciplines of study. Chemistry Technology concentrates on the application of chemistry to real-world situations. Emphasis is placed on creating an understanding of "how chemical changes take place and how to communicate those changes in a clear, precise fashion. The lab phase [develops] techniques and skills necessary to perform various types of data analysis." Medical Biology was developed for students who might be interested in pursuing a career in medicine. "The course focuses on the normal function of the major body systems with an emphasis on abnormal conditions and their treatment" (Barthlomew Consolidated School Corporation 1993).

The Bartholomew Consolidated School Corporation stresses that these courses receive the same credit toward graduation as other courses. Efforts are made to describe the courses in ways that make them attractive to students. Instruction is delivered in a variety of ways, using personnel from business and industry as guest speakers and offering laboratory and exploratory opportunities for students.

## North Carolina

Begun in 1985, the Richmond County, North Carolina, Tech Prep program is among the nation's oldest. After assessing the needs of the community from the perspective of both business and education, a steering committee developed a program based on engineering technology (electrical, industrial, and mechanical), business entrepreneurship, and health and human services (Richmond County Schools and Richmond Community College 1993).

Faculty were involved extensively in curriculum development, resulting in an articulated program of basic subjects for grades 9 through 12 in algebra, geometry, English, biology, government, economics, and U.S. history. In addition, three specific Tech Prep courses of study were designed.

The engineering curriculum includes a beginning course in industrial technology in grade 9, followed by a choice between Introduction to Engineering Technology or Principles of Technology I. At grade 11, options are expanded to include courses ranging from Auto Technology to Graphics.

The business area begins in grade 9 with Keyboarding/Word Processing and moves through Accounting and Marketing. Choices in grade 11 range from Business Law to Administrative Occupations.

The health and human services area begins with a course called Living Technology in grade 9. At grade 10, students may choose among Health Occupations, Child Development, Foods and Nutrition, and Cosmetology. Choices in grade 11 range from Technical Health Occupations to Cosmetology.

The Tech Prep curriculum begins with a common core of learning, a foundation from which students can move into more specialized technical study. Central to the program at Richmond County is an integration of the traditional disciplines with the courses developed for the Tech Prep program. Opportunities for Advanced Placement (AP) credit are made available to students as another way to build articulation between the high school curriculum and postsecondary institutions.

Richmond County Schools have reported impressive results since implementing Tech Prep. SAT scores have risen 47 points since 1985, and the proportion of graduates who declare intentions to pursue postsecondary education has increased from 48% in 1986 to 76% in 1989. Similarly, the dropout rate decreased from 7.2% to 4.8% in the same period (Richmond County Schools and Richmond Community College 1993).

## Texas

Tech Prep programs at Paris, Texas, are available in agricultural technology, business and office systems, health and human services, and industrial technology (Northeast Tech Prep Consortium 1993).

An innovative 2+2 program in nursing is one example of how Tech Prep bridges secondary and postsecondary programs. Students complete two years in the Health Careers program in high school. Then they complete a two-year curriculum in nursing at Paris Junior College. For all phases of the program, competency profiles were developed from the competencies identified in the various nursing occupations (Lovelace et al. 1990).

# Conclusion

Education is a future-oriented institution. But a vision of the future demands an understanding of the present. The world of commerce is undergoing complex changes, giving industrialized nations two choices. They can allow their work forces to slip into obsolescence and their economies to be based increasingly on unskilled manufacturing and service-oriented commerce. Or they can develop a work force suited to international competition. With the first choice, their societies will need to reduce their expectations and settle for a lower standard of living. To create the latter choice, they will need to reform their education systems to produce a work force that is equipped to compete in global markets.

If we choose economic vitality, then we will need to acknowledge that we do not have a match between the modern workplace and today's schools. Both the organization of the workplace and the roles of workers are changing, and the new dimensions of this transformed workplace are not well-served by many current secondary school programs. As Johnston (1993) argues, today's workers are expected to communicate within and outside their immediate workplace. They must cooperate with peers. They must identify and then solve problems. They must constantly retrain as new technologies are introduced. Workers must have these skills if business and industry are to remain competitive in a global market.

Consequently, traditional educational practices no longer apply. Teachers can no longer assume that the transmission of factual infor-



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mation to students is the central goal of schools. Nor can they allow themselves to believe that learning social skills or focusing on personal development without meaningful academic content will lead to valuable learning. Rigorous study of academic subject matter, set in the context of real workplace applications where problem solving and cooperation with others is emphasized, will have to be the cornerstones of the reformed secondary school.

This does not mean that we need more college-educated workers. Johnston (1993) concluded that we have a more-than-adequate supply of college graduates for jobs that require college degrees. But we need smarter workers – workers educated in broader vocational terms and in higher cognitive levels than traditional vocational and technical education programs have provided.

Tech Prep is a reformed curriculum that bridges secondary and postsecondary education. However, merely retooling the curriculum will be insufficient. Teachers will need to develop continuing partnerships with one another, as well as with their peers in business and industry, in order to plan and implement a successful Tech Prep curriculum. In other words, they will need to be empowered to create and define curricula. Curriculum divisions will need to be reorganized along lines of careers, rather than traditional subject divisions. And curriculum leadership will need to emerge from teachers and their peers in business and industry, rather than from bureaucratic lines of authority.

Restructured schools will demand a new breed of professional educator, which means a restructuring of professional education programs also is needed. Entry-level competence for teachers should be defined more comprehensively than classroom instructional skills demonstrated for a few weeks under close supervision. The expanded concept of professional competence will include many facets, beginning with an understanding of the liberal arts and sciences that is both sublime and supple, and ending with lengthened opportunities for practical experience.

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George H. Reavis (1883-1970) entered the education profession after graduating from Warrensburg Missouri State Teachers College in 1906 and the University of Missouri in 1911. He went on to earn an M.A. and a Ph.D. at Columbia University. Dr. Reavis served as assistant superintendent of schools in Maryland and dean of the College of Arts and Sciences and the School of Education at the University of Pittsburgh. In 1929 he was appointed director of instruction for the Ohio State Department of Education. But it was as assistant superintendent for curriculum and instruction in the Cincinnati public schools (1939-48) that he rose to national prominence.

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